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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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AGILENT TECHNOLOGIES, INC.
INTELLECTUAL PROPERTY ADMINISTRATION, LEGAL DEPT.
P.O. BOX 7599
M/S DL429
LOVELAND, CO 80537-0599

EXAMINER	
DUONG, THOI V	

ART UNIT	PAPER NUMBER
2871	

DATE MAILED: 12/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/635,606	KRALIK, JOHN C.	
	Examiner	Art Unit	
	Thoi V. Duong	2871	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 February 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 4-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 4-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 14, 2005 has been entered.

Accordingly, claims 1 and 14 were amended, and claims 2, 3 and 25 were cancelled. Currently, claims 1 and 4-24 are pending in this application.

Claim Objections

2. Claim 23 is objected to because of the following informalities: claim 23 should be dependent on claim 21 instead of claim 17. Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1 and 14 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The specification does not describe "a non-

chiral nematic liquid crystal" recited in claims 1 and 14; the specification only describe "a nematic liquid crystal."

Claims 4-13 and 15-24 are also rejected since they are dependent on claims 1 and 14.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 4-6 and 14-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. (Kondo, USPN 5,625,473) in view of Obikawa et al. (Obikawa, USPN 5,200,110).

Re claims 1 and 14, Kondo discloses a method of fabricating a diffractive or non-dispersive polymer dispersed liquid crystal electrooptic device, comprising the steps of:

providing a non-chiral nematic liquid crystal (col. 14, lines 34-38 and col. 20, lines 4-8);

providing a photo-curable pre-polymer mixture (col. 19, lines 25-47);

mixing said nematic liquid crystal with said photo-curable pre-polymer mixture to form a homogeneous nematic/pre-polymer mixture with said nematic liquid crystal being greater than 40% (by weight) of said combined homogeneous mixture (col. 9, lines 26-33 and col. 20, lines 29-42);

providing a cell comprising a pair of spaced apart transparent substrates 34, 36 that are each coated with a transparent conductive layer 33, 35, without the inclusion of an alignment layer for aligning said nematic liquid crystal as shown in Fig. 8 (col. 9, lines 6-25);

filling said cell with said homogeneous nematic/pre-polymer mixture (col. 4, lines 25-33); and

photo-curing said nematic/pre-polymer mixture using a spatially inhomogeneous illumination source (col. 4, lines 34-37); and

utilizing the above fabricating method to create said diffractive or non-dispersive electrooptic device in the form of a polymer dispersed liquid crystal (PDLC) exhibiting low scattering loss and high index modulation (col. 1, lines 25-40 and 54-65 and col. 20, lines 9-28).

Kondo discloses a liquid crystal electrooptic device that is basically the same as that recited in claims 1 and 14 except for providing a nematic liquid crystal in the form of a eutectic mixture, wherein said nematic liquid crystal has a positive dielectric anisotropy.

Obikawa discloses a nematic liquid crystal in the form of eutectic mixture (col. 2, lines 9-17), wherein said nematic liquid crystal possesses a large positive dielectric anisotropy (col. 3, lines 15-18).

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Kondo with the teaching of Obikawa by employing a nematic liquid crystal in the form of a eutectic mixture, wherein

said nematic liquid crystal has a positive dielectric anisotropy so as to provide an improved liquid crystal compound and obtain a liquid crystal electrooptic device having a wide temperature range and requiring a low driving voltage (col. 3, lines 1-11).

Re claims 4 and 15, Kondo discloses that said substrates are separated approximately 5.5 micrometers by spacers having a particle size of 5.5 micrometers (col. 9, lines 15-20).

Re claims 5 and 16, as shown in Figs. 21-24, Kondo discloses that said PDLC is comprised of a dispersion of discrete droplets 141 containing nematic liquid crystal-rich material in a polymer-rich matrix 132.

Re claims 6 and 17, Kondo discloses that said PDLC is comprised of regions of inter-connected spaces 132 that are filled with nematic liquid crystal-rich material 141 as shown in Figs. 21-24.

7. Claims 7-9, 12, 18-20 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. (Kondo, USPN 5,625,473) in view of Obikawa et al. (Obikawa, USPN 5,200,110) as applied to claims 1, 4-6, and 14-17 above and further in view of Sumiyoshi et al. (Sumiyoshi, USPN 6,278,506 B1).

Kondo in view of Obikawa discloses a method of fabricating a diffractive or non-dispersive polymer dispersed liquid crystal electrooptic device that is basically the same as that recited in claims 7-9, 12, 13, 18-20, 23 and 24 except for the step of deriving said spatially inhomogeneous illumination source used to photo-cure the nematic/pre-polymer mixture from the interference of two coherent optical beams within said cell.

Re claims 7 and 18, as shown in Figs. 5A-5C and 18, Sumiyoshi discloses a method of fabricating a liquid crystal cell (Fig. 5A) comprising the step of deriving a spatially inhomogeneous illumination source 16 used to photo-cure a nematic/pre-polymer mixture 15a from the interference of coherent optical beams LB11 and LB12 within the cell to produce a plurality of phase gratings for increasing the intensity of transmission light (col. 7, lines 52-56 and col. 10, lines 6-48).

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the method of fabricating a diffractive or non-dispersive polymer dispersed liquid crystal electrooptic device of Kondo with the teaching of Sumiyoshi by employing two interfering optical beams to produce a plurality of phase gratings for increasing the intensity of transmission light (col. 7, lines 52-56).

Re claims 8 and 19, it is obvious that the coherent optical beams (laser beams) each have a wavelength in the ultraviolet spectrum for radiating the photo-curable polymer.

Re claims 9 and 20, Fig. 18 shows the incident angle AGL1 and the azimuth angle AGL2 of the beams wherein AGL1 of the beam LB12 is fixed to zero by regulating the reflecting mirrors 16d and 16e while the beam LB11 is incident with a certain incident angle AGL1 to produce a first multilayer structure for the mixture. Further, a second multilayer structure is created in the mixture by changing the reflecting mirror 16c in such a manner as to maintain the incident angle AGL1 and changing the incident azimuth AGL2 by 180 degrees for the beam LB11. Accordingly, an unslanted PDLC transmission grating will result when the interfering optical beams LB11 (in incident

direction DR) are incident symmetrically about a direction normal to said cell (col. 10, lines 15-48).

Re claims 13 and 24, as shown in Fig. 8, Sumiyoshi discloses that the nematic the nematic liquid crystal in the nematic-rich regions in the PDLC contains a high degree of orientational order ans has its nematic director substantially aligned along a uniform orientation OR2 in a grating layer 15f when no drive field is applied across said cell (col. 7, lines 17-38).

8. Claims 10-12 and 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al. (Kondo, USPN 5,625,473) in view of Obikawa et al. (Obikawa, USPN 5,200,110) and Sumiyoshi et al. (Sumiyoshi, USPN 6,278,506 B1) as applied to claims 7-9 and 18-20 above and further in view of Popovich et al. (Popovich, USPN 6,339,486 B1).

The diffractive or non-dispersive polymer dispersed liquid crystal electrooptic device of Kondo as modified in view of Obikawa and Sumiyoshi above includes all that is recited in claims 10, 11, 21 and 22 except for a grating period that is greater than half the wavelength of the light to be diffracted by the PDLC transmission grating during use of said transmission grating and a spatial frequency that is sufficiently high to prohibit propagating diffracted orders for normal incident light, thereby creating an electrooptic retarder with electrical tunable birefringence.

As shown in Fig. 13, Popovich discloses a transmission grating 200 having periodic planes of polymer planes 200a and PDFC plane 200b wherein each polymer plane has a thickness t(P) and each PDLC plane has a thickness t(PDLC), and the

combined thickness of the PDLC plane and the polymer plane is a grating period which is less than an incident optical wavelength to exhibit form birefringence (col. 15, lines 1-4 and col. 17, lines 1-10). Accordingly, the grating period can be selected to be greater than half the wavelength of the light to be diffracted by the PDFC transmission grating during use of said transmission grating. Popovich also discloses the transmission grating with a spatial frequency that is sufficiently high to prohibit propagating diffracted orders for normal incident light, thereby creating an electrooptic retarder with electrically tunable birefringence (col. 9, line 64 through col. 10, lines 7; and col. 15, lines 1-15). Similarily, Popovich discloses that a high birefringent static sub-wavelength wave-plate can also be formed.

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the device of Kondo with the teaching of Popovich by forming the unslanted PDLC transmission grating with a grating period that is greater than half the wavelength of the light to be diffracted by the PDLC transmission grating during use of said transmission grating or a spatial frequency that is sufficiently high to prohibit propagating diffracted orders for normal incident light, thereby creating an electrooptic retarder with electrically tunable birefringence or a retarder so as to improve the display brightness (col. 9, line 64 through col. 10, lines 7; and col. 15, lines 1-15).

Re claims 12 and 23, as shown in Fig. 8, Sumiyoshi discloses that the nematic the nematic liquid crystal in the nematic-rich regions in the PDLC contains a high degree of orientational order ans has its nematic director substantially aligned along a

uniform orientation OR2 in a grating layer 15f when no drive field is applied across said cell (col. 7, lines 17-38).

Response to Arguments

9. Applicant's arguments filed February 28, 2005 have been fully considered but they are not persuasive.

Re claims 1 and 14, Applicant argued that a nematic liquid crystal provided by Kondo is not supported by the text as Kondo specifically teaches that "the liquid crystal material used in the present invention includes a two-frequency drive liquid crystal with negative dielectric anisotropy and nematic liquid crystal with cholesteric liquid crystal." The presently claimed invention uses nematic liquid crystals with positive dielectric anisotropy. In addition, the liquid crystal material used in Kondo contains a photo-curable liquid crystal component (col. 19, lines 62-66), which is contrary to the concept of the present invention which employs a non-photo-curable nematic liquid crystal.

The Examiner disagrees with Applicant's remarks since nematic liquid crystal with no chiral dopant added is supported by Kondo (col. 14, lines 35-39 and col. 20, lines 4-8). Moreover, Kondo discloses a mixture comprising a liquid crystal material and a photocurable resin (col. 2, lines 57-58 and col. 19, lines 24-66). It is noted that a non-photo-curable nematic liquid crystal is not recited in the claims.

However, since Kondo does not disclose a nematic liquid crystal having a positive dielectric anisotropy, Obikawa is employed for teaching a nematic liquid crystal with a large positive dielectric anisotropy to provide an improved liquid crystal

compound and obtain a liquid crystal electrooptic device having a wide temperature range and requiring a low driving voltage (col. 3, lines 1-11).

Re claims 1 and 14, Applicant argued that Kondo does not address the specific step of cell filling. The Examiner disagrees since Kondo does discloses a step of injecting a mixture including liquid crystal and photocurable resin for filling the cell (col. 2, lines 57-58).

Re claims 1 and 14, Applicant argued that the method for curing the display device in Kondo is markedly different from the method taught by the present invention and further, Kondo cures the display device at elevated temperature while the device of the present invention is cured at room temperature. The Examiner disagrees since Kondo discloses the method for curing the display device using a spatially inhomogeneous illumination source as claimed (col. 9, lines 34-42). Moreover, Applicant does not claim curing at room temperature.

Re claims 1 and 14, Applicant argued that Kondo discloses how to build a display "so that the transmittance and contrast are low" from a Japanese Laid-Open Patent Publication No. 5-27242 (col. 1, lines 55-56) whereas the present invention teaches how to build high contrast, low loss PDLC electrooptic device and employs "index modulation," referring specifically to half the difference between the indices of refraction of the liquid crystal-rich, and polymer-rich regions in the device. The Examiner disagrees with Applicant's remarks. Because of problems with Prior Art, Kondo discloses how to build a display device employing "index modulation" to exhibit low scattering loss and provide excellent viewing angle characteristics and high contrast

characteristics (col. 1, lines 25-40, col. 20, lines 9-28 and col. 22, lines 13-32). Moreover, Applicant does not claim that "index modulation" specifically refers to half the difference between the indices of refraction of the liquid crystal-rich, and polymer-rich regions in the device.

Re claims 5, 6 and 17, Applicant argued that Kondo teaches away from using nematic phase liquid crystal. The Examiner disagrees since, as indicated above, the liquid crystal can be a nematic liquid crystal.

Re claims 7 and 18, Applicant argued that Sumiyoshi teaches photo-curing that differs with the presently claimed invention since Sumiyoshi photo-cures uses an electric field across the cell, while the present invention does not. However, the reference of Sumiyoshi is still read on the claims since Applicant does not claim that photo-cure does not use an electric field.

Re claims 8 and 19, Applicant argued that it is relevant to specify the wavelengths of operation for the lasers since the absorbance bands of photo-initiators can be wider than 100 nm and extend beyond 400 nm. However, as known in the art, the UV spectrum has a range from 50 nm to 400 nm; therefore, it is obvious that the coherent optical beams each have a wavelength in the UV spectrum for radiating the photocurable polymer.

Re claims 9 and 20, Applicant argued that Sumiyoshi does not produce unslanted gratings. The Examiner disagrees since, as shown in Fig. 18, Sumiyoshi discloses that the incident angle AGL1 of the interfering optical beams, which is used to produce the first multilayer structure, is maintained to form the second multilayer

structure (col. 10, lines 36-43). Accordingly, an unslanted PDLC transmission grating will result when the interfering optical beams are incident symmetrically about a direction normal to the cell.

Finally, re claims 10-12 and 21-23, Applicant argued that Popovich teaches the PDLC material containing less than 40% liquid crystal content, while the present invention uses PDLC containing more than 40% nematic liquid crystal content. The Examiner disagrees since Kondo discloses a liquid crystal electrooptic device comprising a homogeneous nematic/pre-polymer mixture containing more than 40% nematic liquid crystal content and Popovich is employed for teaching forming a unslanted PDLC transmission grating with a grating period that is greater than half the wavelength of the light to be diffracted by the PDLC transmission grating during use of said transmission grating or a spatial frequency that is sufficiently high to prohibit propagating diffracted orders for normal incident light, thereby creating an electrooptic retarder with electrically tunable birefringence or a retarder so as to improve the display brightness (col. 9, line 64 through col. 10, line 7 and col. 15, lines 1-15).

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thoi V. Duong whose telephone number is (571) 272-2292. The examiner can normally be reached on Monday-Friday from 8:30 am to 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim, can be reached at (571) 272-2293.

Thoi Duong

11/16/2005

ANDREW SCHECHTER
PRIMARY EXAMINER